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W. C. Fischer

Guide for

FOREST SERVICE RESEARCH SCIENTISTS

U.S. Department of Agriculture • Forest Service

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Memorandum

Department of Agriculture—Forest Service
Washington, D.C. 20250

TO : All Research Personnel

File No. 4050

FROM : George M. Jemison, Deputy Chief

Date: June 25, 1968

SUBJECT: Research Programs

Your reference:

This Guide contains the policy, definitions, and procedures that each Forest Service researcher, from bench scientist to Director, needs to know in order to formulate and carry out research programs. The material is taken from the Forest Service Manual, which is the basic component of the Directive System. The text consists of the Research Program Chapter (FSM 4050).

I hope each of you will study this Guide carefully. It should be especially useful to those who have recently joined the Forest Service Research organization. As you know, Forest Service Manual materials are constantly being updated, and each updating produces some obsolescence in this Guide. For this reason you should refer to the Manual itself for any situation requiring specific decisions when you have a question. Despite the problem of gradual obsolescence, I hope you will find the Guide an informative and useful desk reference.

George M. Jemison

Contents

	Page
Policy	2
Definitions	3
Current Research Information System	5
RESEARCH PROGRAM FORMULATION	5
National Program	9
Station Programs	9
Problem Selection	10
Problem Analysis	11
Research Work Unit Descriptions	12
Department Review of and Concurrence in Research Work Units	17
Study Plan	17
Pioneering Research Unit	18
Inter-Station Research Coordination	27
Current Program Financing	27
RESEARCH PROGRAM REPORTING	28
Research Work Unit Annual Reports	28
Study Reports	33
Establishment Reports	33
Progress Reports	33
Final Report	33
Pioneering Research Unit Annual Report	33
RESEARCH PROGRAM REVIEW	34
Annual Review by National Forestry Research Advisory Committee	34

	Page
Periodic Inspections by Washington Office Research	34
General Research Inspection	34
General Functional Inspection	35
Functional Supervision by Research	35
Review and Revision of Research Work Unit Descriptions	36
Discontinuance of Research Work Units	36
Duration of Research Work Units	37
RESEARCH SUPPORT FROM OTHER AGENCIES	37
Support by Non-Federal Agencies	38
Support by Other Federal Agencies	38
RESEARCH SUPPORT FOR OTHER AGENCIES	39
Whitten Act Grants	39
Public Law 85-934 Research Grants	40
Forestry Research Grants Handbook (FSH)	41
Public Law 89-106 Research Grants	41
Public Law 480 Grants to Foreign Universities	41
Handbook on Foreign Research FSH)	41
RESEARCH STRUCTURES	41
OPERATING TITLES FOR SCIENTISTS	42
Research Staff Titles	42
Research Organizational Titles	43
Research Work Unit	43
Pioneering Research Unit	43
Laboratory	43
Research Management	44
Fields of Specialization for Use in Operating Titles-*	45

*-Under authority of the McSweeney-McNary Forestry Research Act, as amended and supplemented, the Forest Service carries on a balanced research program to help solve the forestry problems confronting the Nation. The research program supports forestry activities on National Forest and other publicly administered lands and on privately owned forest lands, including the small woodland properties. The research covers problems in five forest- and range-resource production and management fields--timber, range forage, wildlife habitat, and recreation. It deals with problems of protecting these resources from fire, insects, disease, and other natural destructive agents. Timber harvest engineering and forest products utilization research are included. The program also (1) covers research in forest economics and forest-products marketing and (2) keeps timber-resource supply and demand information up to date. Thus, it spans the whole spectrum of forestry problems.

Forest Service research is under the overall planning, direction, and coordination of a Deputy Chief who has staff-line responsibilities. He is assisted by a headquarters staff grouped generally into five research divisions. The in-house research is done at some 80 locations throughout the United States and Puerto Rico. Most of the locations are on or near university or college campuses.

The research program is organized for the most part under the management of Directors (and Assistant Directors or division chiefs) of Regional Forest and Range Experiment Stations; the Forest Products Laboratory at Madison, Wisconsin; and the Institute of Tropical Forestry in Puerto Rico. Some research is done in Washington, D. C., and Beltsville, Maryland, under the administrative direction of the Washington Office Research divisions.

The research, with few exceptions, is done within the missions of approved Research Work Units. Each Research Work Unit has a Research Project Leader. The scientists assigned to Research Work Units, along with their Leaders, constitute the research-doing part of the program.

The research arm of the Forest Service is a line organization with authority descending from the Chief of the Forest Service to the Station Directors and, in turn, to the Assistant Directors and Research Project Leaders. The Chief delegates to the Deputy Chief for Research the main line responsibilities for general conduct of the research program. The Washington Office Research division directors serve the Deputy Chief for Research in a staff capacity.-*

*-At the Experiment Stations, the Assistant Directors, in addition to their line responsibilities in a subject-matter field, serve the Directors in a staff capacity.

This series zero code presents the policy, definitions, and essential procedures which Forest Service research directors and scientists need to understand in order to formulate and carry out the research program.

4050.3 - Policy. To achieve its research program objectives, Forest Service will:

1. Carry on the research within the framework of a periodically projected national program of forestry research in which carefully planned and coordinated lines of research are identified and set forth to solve major problems of high priority.

2. Conduct research directly with its own scientists and indirectly with university and other scientists with support of Forest Service funds.

3. Carry on the research, both direct and indirect, under the Department of Agriculture's uniform project system and within approved Research Work Units, with exceptions only as specifically authorized by the Deputy Chief for Research. This usually involves research to be done by the Forest Service for another Federal agency.

4. Organize the research effort at its Stations in a manner that seeks to separate the responsibility for research support services from the actual performance of research.

5. Cooperate with other agencies, public and private, in the interests of a coordinated and effective national forestry research program. Much of this may be done by working with State experiment stations, forestry schools, and other departments of universities, and with industries and other private agencies and individuals.

6. Promptly publish research findings and disseminate results in a manner to encourage their acceptance and use. Appropriately assist user agencies and individuals in applying research results. Much of this may be done by the Forest Service research organization working with the National Forests and State and private organizations of the Forest Service. Some of it may best be done by working directly with industrial and other public and private groups. -*

*-4050.5 - Definitions. Selected terms with their meanings follow:

1. In-House and Extramural Research. In-house research is that done by Forest Service scientists. It is sometimes referred to in published reports as intramural research or is spoken of as direct research. Extramural research is that done by non-Federal scientists with the support of Forest Service funds. It is sometimes termed indirect research. Extramural research may be done under contract or grant. The research grant is the usual means through which the Forest Service makes funds available to non-Federal agencies. There are several kinds of grants. In the domestic field there are (1) research grants (P. L. 106 and 934) and (2) Whitten Act grants or cooperative-aid (P. L. 473). In addition there are foreign research grants (P. L. 480). These are explained in more detail under FSM 4055 and 4040.

2. Station. The term "Station" is used in the Forest Service with two meanings. The more specific meaning is a Forest Service Regional Forest and Range Experiment Station. The other meaning, often implied, is any major field unit of the Forest Service reporting directly to Washington, as the Institute of Tropical Forestry (ITF) and the Forest Products Laboratory (FPL). It is common internal practice, for example, to say "Stations" when the FPL and ITF also are meant to be included. The term often is used in this manual with this intended meaning. By analogy, instructions identified for Stations sometimes apply to those Washington Office divisions which have Research Work Units under their supervision.

3. Uniform Project System. This means the system of the United States Department of Agriculture for classifying the research work of the Department into the following categories: (1) Financial project, (2) work project, and (3) Research Work Unit.

4. Financial Project. This is the first category of the classification scheme. In the Forest Service, there are four financial projects as of 1968: (1) Forest and range management research, (2) forest protection research, (3) forest products and engineering research, and (4) forest resource economics research.

5. Work Project. This is the second category of the classification scheme. As of 1968, there are from three to nine work projects under each financial project. In most cases, the work project corresponds with the field of responsibility of a Research branch in the Washington Office. This facilitates financial and work progress reporting. In those few instances where such a relationship does not now exist, revisions in the current work projects may be made in the future. -*

*-6. Research Work Unit. This is the third and final category in the classification scheme of the Department's uniform project system. It reflects a specific line of investigation or field of research at a single headquarters location under a work project (FSM 4051.5). In the Forest Service, the Research Work Unit has the additional function of serving as the unit organization. It also provides a convenient unit for financial control of funds and the reporting of research results.

In concept and practice, the Research Work Unit description in the Forest Service is the working document for program guidance, coordination, review and exchange of information among scientists and research administrators. The Research Referral Office (RRO), under the Department's Director of Science and Education, serves as a repository for the original copies of signed Research Work Unit summary documents submitted to RRO for review and concurrence. The current research information system (CRIS) of the Department, under development as an automatic data processing system, stores and retrieves the information contained in the Research Work Unit summary descriptions from the Department, State, and other research agencies (FSM 4050.6).

7. Pioneering Research. The concept of pioneering research envisions basic research of a high order performed by competent scientists of proven excellence. Pioneering Research Units are given a broad charter outlining a problem area. The scientist is free to develop his program as he chooses within the framework of this charter. Pioneering Research Units do not follow the research documentation procedures outline for Research Work Units. This does not imply that basic research is done only in pioneering units; it is also done in most of the Research Work Units. However, the work under a Research Work Unit usually includes some applied research and is directed toward the solution of specified problems.

8. Program Formulation. This is the entire process of developing the research program. From the vantage point of Stations, it includes two distinct steps: (1) Selection of problems for each assigned Research Work Unit that are of the highest priority and strongly justified for research and (2) the analysis of each selected problem which leads to a plan of work with identified studies. A detailed explanation of these steps and associated documents is given under FSM 4051 following the explanation of other important features of overall program formulation.

9. Mission. This is the statement of an overall long-range assignment or objective for a research endeavor--usually describing coverage of a Research Work Unit. -*

*-10. Problem. This is a specific question raised or task set for inquiry and solution. Problems should be defined in terms leading to solution. The distinction between a topic and a problem should be kept clear. For example, geographic variation in southern pines is a topic; inadequate information on the limits of northward movement of slash pine is a problem.

11. Problem Selection. This is the first step in program formulation at the Station level where the choice of problems is made and the priorities established. Selected problems and general approaches to solutions are documented in the Research Work Unit description.

12. Problem Analysis. This is the job of analyzing in depth selected problems assigned to the Research Work Unit. Each selected problem requires an analysis as a basis for setting up the needed research in terms of attackable segments through specific studies with indicated priority. The document setting forth this analysis will have the term "problem analysis" in its title.

13. Study Plan. This is the plan for a formally established study designed to contribute to solution of a selected problem. The document setting forth this plan will have the term "study plan" in its title.

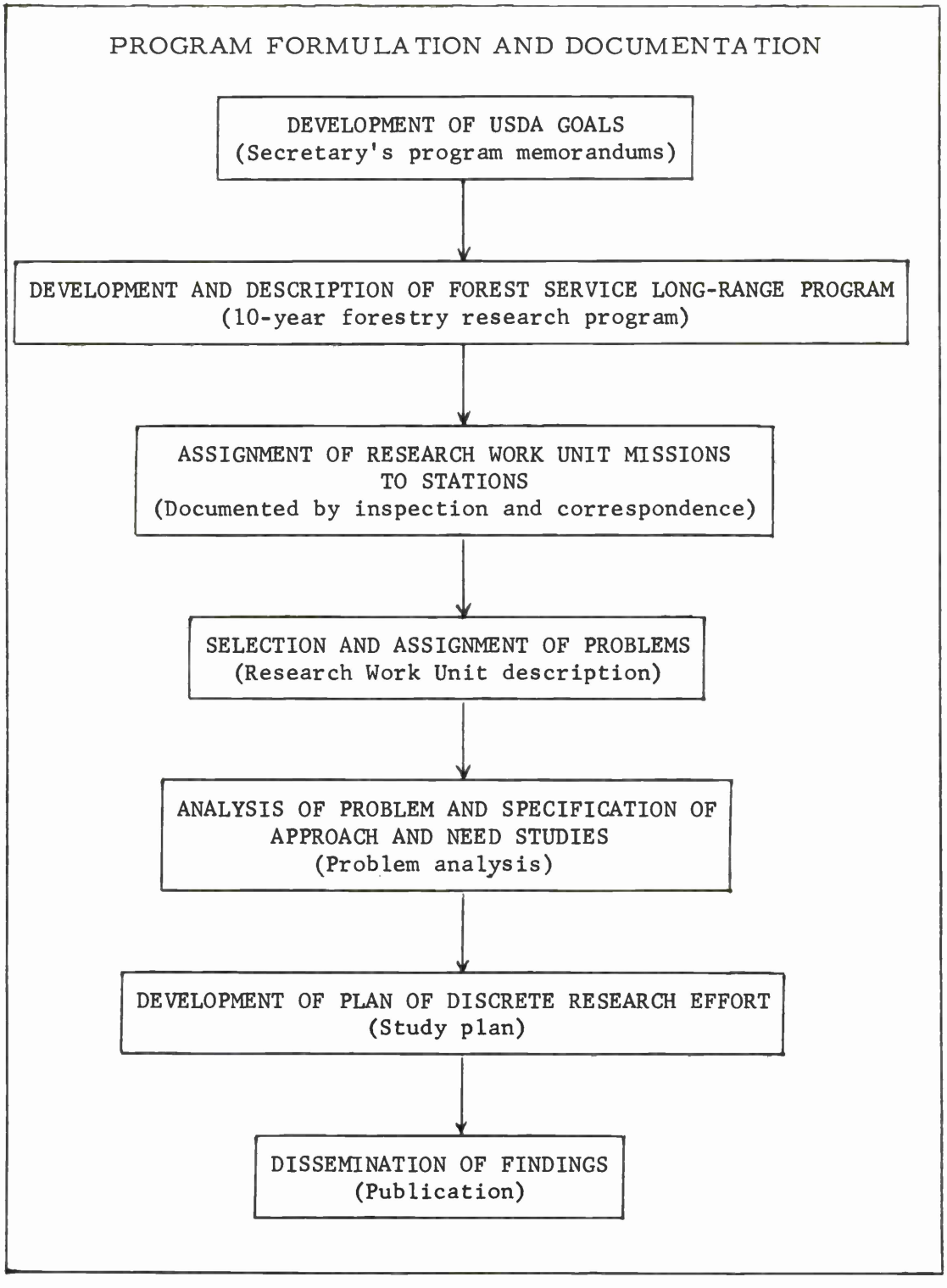
4050.6 - Current Research Information System. The current research information system (CRIS) is designed to furnish management and planning information to Department, other Federal and State research administrators, and scientific information to the entire scientific community. Fiscal information aggregated by categories will be available only for official program planning and reporting. The system will be capable of sorting, assembling, and printing out information for a wide range of special reports and in answer to a variety of questions including those related to program formulation and planning.

CRIS will be compatible with a proposed Government-wide system of automated storage and retrieval of information on current programs of research and development. CRIS will contain data on the research and development program in the entire field of agriculture conducted by Department and the State agricultural experiment stations.

4051 - RESEARCH PROGRAM FORMULATION. Formulating the Forest Service research program involves participation of many Forest Service individuals both inside and outside the research organization (exhibit 1 at end of section). It must be accomplished-*

-within the framework of laws, congressional appropriations, Department regulations, and the interdepartmental and intradepartmental coordinating devices at the national level as well as with appropriate interpretations and applications of these measures at the Regional level. Formulation must also provide for the look ahead in terms of a projected program as well as the translation of urgent problems into current research. There is participation among all levels of the organization. Yet at each level there are special or unique practices, responsibilities, and authorities that can be identified (exhibit 2 at end of section). -

*-Exhibit 1


PROGRAM FORMULATION AND DOCUMENTATION
DEVELOPMENT OF USDA GOALS
(Secretary's program memorandums)
DEVELOPMENT AND DESCRIPTION OF FOREST SERVICE LONG-RANGE PROGRAM
(10-year forestry research program)
ASSIGNMENT OF RESEARCH WORK UNIT MISSIONS
TO STATIONS
(Documented by inspection and correspondence)
SELECTION AND ASSIGNMENT OF PROBLEMS
(Research Work Unit description)
ANALYSIS OF PROBLEM AND SPECIFICATION OF
APPROACH AND NEED STUDIES
(Problem analysis)
DEVELOPMENT OF PLAN OF DISCRETE RESEARCH EFFORT
(Study plan)
DISSEMINATION OF FINDINGS
(Publication)

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*-Exhibit 2

RESEARCH PROGRAM DOCUMENTATION AND REVIEW

Document responsibility	10-year program	Research Work Unit description, including problem selection	Problem analysis	Study plans and establishment reports	Research Work Unit annual report	CRIS form 1, parts 1 (AD-416) and 2 (AD-417)	CRIS form 1, parts 3A (AD-418) and 3B (AD-419)	CRIS form 1, part 4 (AD-421)
FSM reference	4051.1	4051.5	4051.4	4051.6 4051.7	4052.1	4051.5	CRIS instructions	4052.1 4052.3
Scientist				Preparation (Review by biometrician)				
Research Project Leader			Preparation (May delegate to scientist)	Approval	Preparation			Preparation
Station Assistant Director		Preparation	Approval	Information	Review	Preparation recommendation	Preparation RSS	Review
Station Director	Supply information and recommendation	Approval	Information		Information, inspection	Approval	Information	Information
Washington Office division	Supply information and recommendation	Review, recommendation, inspection	Information		Information	Completion part 2, recommendation	Information	Information
Deputy Chief for Research	Approval	Review			Information	Concurrence	Verification	Information
Research Referral Office						Concurrence		
Current research information system						Information input	Information input	Information input
Time interval	Keep current	5 years or less	As needed	As needed	Annual	5 years or less	Annual	Annual

*-4051.1 - National Program. At the national and international level the responsibility of formulating the long-range research program falls heavily on the office of the Deputy Chief for Research with participation by Washington Office Research. An example of a projected program is "A National Program of Research for Forestry" which outlines a 10-year program for the fiscal-year period 1967 to 1977. This program was prepared by the Forestry Task Force of the Agricultural Research Planning Committee of the United States Department of Agriculture and the State Universities and Land Grant Colleges in July 1967. It provides the framework and guide for translating forestry research program and laboratory facility needs into the budgetary process and it furnishes a basis for classifying the research to be done into financial projects, work projects, and Research Work Units. The 10-year projected program was formulated after a thorough review of current and anticipated research needs, the nature and number of Research Work Units that would be required, the best locations for the research, and the number of scientists and research facilities needed to implement the program. The Station Directors and their staffs, as well as Washington Office Research, advise the Deputy Chief for Research in the selection and distribution of Research Work Unit assignments.

4051.2 - Station Programs. The development of the research program at a Station begins with the assignment of Research Work Units to each Station.

Authorization and assignment of Research Work Units rest with the Deputy Chief for Research. It is a continuing process as new problems arise, answers to old problems are found, and priorities change. Stations, with advice of Washington Office Research, should suggest initiation of Research Work Units, the discontinuance of old ones, or changes in existing Units as needed to meet changing problem situations. However, the Deputy Chief for Research approves all Unit deletions, additions, and inter-Station assignments or reassignments. This process ensures national coordination of forestry research and provides an essential input from the field to ensure maximum flexibility to keep the entire program concentrated on the highest problems, with assignments directed to the best suited locations.

The Station Director assigns each Research Work Unit to an Assistant Director. Because Research Work Units have functional relationships, they are grouped into Assistant-Director areas of responsibility. Such grouping is necessary to facilitate financial planning for related program areas and to center responsibility for review and contact by each Washington Office branch to one Station acting director.-*

*-Grouping tends to maintain fund allocation by broad functions providing for Station flexibility in adjustment between Research Work Units in the same general financial areas.

The assistant-director area of administrative responsibility, however, is not usually unifunctional. It is vital to view the assistant director positions as an interdisciplinary line extension of the Director's office to accomplish program formulation, review, and guidance functions.

Assistant Directors are responsible for the problem selection (FSM 4051.3), the process by which all aspects of a Research Work Unit mission are analyzed and specific parts, or problems, are selected for research programing. The selected problems are the basis for the active research program and are specified in the Research Work Unit description. Documentation of the problem selection is a vital step in Station program formulation. Essential information will be recorded in a Research Work Unit description (FSM 4051.5) prepared by the assistant director. The description will provide a statement of the mission or continuing goal of the Research Work Unit. This document will describe the selected problems, explain why they are selected and of high priority, and will outline the general approach to be followed in the research. Problem selections are modified as needed to meet changing patterns in the national program, changes in problem priorities and assignments, and progress in problem solution. The documentation of the needed changes and decisions at the Station level will appear in reports of general research inspections, general functional inspections, and appropriate correspondence.

Following completion of the problem selection and its documentation in the Research Work Unit description, the project leader for each Research Work Unit makes a problem analysis (FSM 4051.4), a process by which he determines the manner in which assigned problems will be attacked--the detailed plan for problem solution. The analysis of each problem will result in a document which will be approved by the responsible Assistant Director.

4051.3 - Problem Selection. To accomplish the problem selection, the Assistant Director must identify within each Research Work Unit, the individual problems and their corresponding priorities for solution. Some problems will be more urgently in need of solution than others. Observations, meetings with Station advisory committee, discussions with the Regional Forester, Area Director, other Federal resource managers, State officials, leaders of industry, university staffs, and others will provide the Assistant Director with much of the background needed to select the problems of-*

*-highest priority. In the selection of problems, the Assistant Director will give consideration to availability of resources, including scientists, scientists' support facilities, and funds.

4051.4 - Problem Analysis. The problem analysis is a documented review of the state of knowledge pertaining to each problem that has been selected and assigned to a Research Work Unit in the process of its establishment or development. Furthermore, it outlines a plan of attack in the new or continuing research required and sets up priorities for individual studies involved. A problem analysis report, including a plan of work, will be prepared for each selected problem.

The Research Project Leader is responsible for preparing each problem analysis. With the approval of the Assistant Director concerned, he may delegate the task to another scientist. The Assistant Director approves the problem analysis.

A standard outline and length for a problem analysis is neither necessary nor desirable. The required written document is a working paper that records the expert thinking and review of the Research Project Leader or of a scientist he may assigned to the task. It may be reviewed by others but normally will not be published. Important points usually covered in the analysis are:

1. Precise definition of the problem.
2. Review of pertinent literature and work underway elsewhere.
3. Breakdown of the problem into reasonable components.
4. Research attack proposed.
5. Specific studies indicated and their priority.
6. Time schedule for studies to be started.
7. Cooperative personnel and facilities available and desirable coordination with other research.

The Research Project Leader is responsible for the contents of a problem analysis and the priority list of studies that is developed. However, he will usually seek counsel from the appropriate Assistant Director. They will work together and reach agreement on the scheduling of studies--the Assistant Director contributing on the basis of his knowledge of priority problem situations and the Research Project Leader on the basis of his technical experience on-*

*-how the research assignment must be attacked. This joint approach ensures common understanding of the work to be done and creates a degree of flexibility in research planning that helps keep investigations bearing directly on the most critical problems.·

4051.5 - Research Work Unit Descriptions. Before research may be started on any assignment, a Research Work Unit description must be developed and approved. Research Work Unit descriptions are the key documents outlining the results of the program formulation process. They require joint participation of the Washington Office and Stations. The Research Work Unit description states the mission, selected problems, approach, and related aspects of the research assignment. It projects a line of investigation over a 5-year period. The description should be written in concise terms. Subsequently, a continuing process of review by the Research Project Leader and by means of functional supervision visits by the appropriate Assistant Director will bring about the desired refinement of the actual program of studies to be followed under each problem (FSM 4051.4). It is important that Research Work Unit descriptions be considered as flexible program guides that can be revised as needed to permit the research to be currently aimed at high-priority problems. The Assistant Director of a Station is responsible for preparation of the description but he may call upon the Research Project Leader or other scientists for assistance.

The authority to approve Research Work Unit descriptions and Research Work Unit project descriptions is delegated by the Deputy Chief for Research to the Station Director. After approval by the Station Director, the description is forwarded to the Washington Office for review by and concurrence of the Deputy Chief for Research.

In addition, descriptions for Research Work Units to be financed as Forest Service grants, or for selected projects handled directly from the Washington Office to which Research Work Unit procedures are applicable, will be initiated by the branch chief for the subject-matter area. In such cases, approval by the division director parallels that for descriptions originating at the Stations and approved by Station Directors.

Research Work Unit descriptions shall be reviewed at least every 5 years, following the general functional inspection by the appropriate Washington Office division. Four copies are submitted to the Washington Office.

The description of a proposed Research Work Unit is prescribed as shown in exhibit 1 at the end of this section. Detailed discussion of major description items follows:-*

*-1. Mission. (Exhibit 1, item 8.) The statement of mission should define the overall long-range assignment of the Research Work Unit.

2. Justification and Problem Selection. (Exhibit 1, item 9.) The justification statement draws on the material developed during the problem selection process. It should include a description of the current need for the research and its potential value and relation to other work. This statement must be a concise appraisal of the mission and show the rationale used in selecting problems. The Research Work Unit description will identify only those problems of highest priority that have been selected and that are consistant with current (or immediately foreseeable) resources, including scientists, scientists' support facilities, and funds. The problems must be stated as specific questions to be answered or as specific tasks to be completed. A problem statement should not be confused with the mission statement. A well-defined problem leads directly to one or more studies, each of which bears directly on its solution. Precise problem definition is fundamental to efficient research.

3. Approach to Problem Solution. (Exhibit 1, item 10.) The approach to the solution of each selected problem should be given, drawing from the material developed through the problem analysis. At this stage of planning, specific studies and timetables may or may not have been decided upon. The approach should be stated in terms which will serve to guide the development of a plan of work. For example, studies of fertilization response might be carried out in growth chambers, in greenhouses, in nurseries, in plantations of various ages, or in natural stands. Such decisions on the approach can be made at the time problems are selected because the cost and feasibility of solution are important aspects of establishing priorities for problems. -*

*-Exhibit 1

UNITED STATES DEPARTMENT OF AGRICULTURE
RESEARCH WORK UNIT DESCRIPTION

1. No.: FS-NE-1501.

2. Station: Northeastern Forest Experiment Station.

3. Headquarters Location: Burlington, Vermont.

4. Research Work Unit Title: Sugar maple sap production--including methods technology, tree improvement, and establishment of superior stock (Sugar Maple Sap Production).

5. Project Leader, Social Security Number and Address: Albert G. Snow, Jr., 217-42-4179 Burlington, Vermont

6. Area of Research Applicability: Ind., Ohio, Penna., Mass., Md., Me., Mich., N.H., Vt., N.Y. (commercial maple sugar region)

7. Estimated Duration: Continuing

8. Mission: To develop more efficient methods of producing sugar maple sap.

9. Justification and Problem Selection: The maple syrup industry is important to the economy of many rural sections in 13 of the northern states from Maine to Minnesota. The average annual production of 1,500,000 gallons of syrup, gives seasonal employment to about 20,000 people. Although this level of production has remained relatively constant for the past six years, it represents a downward trend since 1918 from a peak four times higher. Labor shortages, changes in rural customs and practices, increased cutting for lumber, and a steady rise in production costs, contribute to this decline.

   Failure to fully utilize existing opportunities for maple sap production means that many individual owners of small woodlands are not realizing the potential income from their holdings. Research can make significant contributions toward increased operating efficiency to enhance the earnings of individual sap producers and help achieve economic stability in the areas concerned. -*

To achieve operational efficiency in this industry, solution of the problem of Marginal Sap and Sugar Production Techniques is of greatest priority. Although the more progressive sugar maple sap producers have improved their woods practices in a small way, the majority still use methods of tapping and sap collection that require much harder hand labor. It is in this problem area that the greatest progress can be made in the near future to increase efficiency and make a profitable sap-producing enterprise possible.

In addition, lasting benefits will result from research to solve the problem caused by a Lack of Superior Genotypes. Some trees are known to produce sap with more than twice as much sugar as average trees. Operations in sugar bushes of superior trees will not only reduce sap production costs, but will also result in reduced processing costs. Research is needed to establish criteria for selecting these trees, and to develop breeding methods so sweet-tree seedlings can be produced.

Furthermore, the full potential of research results in sap production techniques and genetic improvement cannot be achieved without solving the problem of Inadequate Stock and Methods of Stand Regeneration. This involves all phases of the problem of sugar maple establishment, including nursery procedures, asexual propagation, and seeding and planting under various field conditions.

Solution of the various aspects of these problems will culminate in the ultimate use of the most modern sap production technology, the best possible genetic stock, established in well-managed sugar orchards of the future.

10. Approach to Problem Solution

Problem 1 - Marginal Sap and Sugar Production

Full analysis of this problem should include determination of the feasibility of programming studies to secure improved extraction and collection of sap, increased sap yield and sugar content, and improved sugar-bush management--all largely through field research. -*

*-Exhibit 1--Continued

Problem 2 - Lack of Superior Genotypes

Solution of this problem is likely to be best achieved through conventional tree breeding methods. Analysis of the problem should include the feasibility of establishing studies to select and evaluate high yielding phenotypes through comparison between and within geographic source locations, selection of high yielding progenies, development of pollination techniques and study basic flower and seed morphology and physiology.

Problem 3 - Inadequate Stock and Methods for "Sugar Bush" Establishment

To overcome this obstacle and secure profitable future incomes from maple products it will be necessary to fully analyze this problem and, thence, program research which will provide both the stock and the stand establishment methods. The feasibility of implementing studies to provide knowledge of seed crop periodicity, seed dormancy, storage methods, flower and seed stimulation should be analyzed. Opportunity for work with nursery methods, stock grading, vegetative propagation and site preparation would be considered.

11. Recommendation, approval and concurrence:

Signature	Title	Date
Recommended	Assistant Director	
	Branch Chief	
	Division Director	
Approved	Station Director	
Concurred	Deputy Chief for Research	

-*

*-4051.51 - Department Review of and Concurrence in Research Work Units. In addition to the detailed Research Work Unit description needed for internal program review and approval, it will be necessary for the responsible Station Assistant Director to prepare and submit a Department and State agriculture experiment station Research Work Unit Project Description: Research Resumé, CRIS form 1-part 1 (AD-416). These will be completed through 30. The appropriate Washington Office division will complete part 2 of CRIS form 1 (AD-417), using current instructions before forwarding to the Deputy Chief for concurrence. Parts 1 and 2 (AD-416 and 417) will be forwarded to the Department's Research Referral Office (RRO) for interagency review and concurrence after the Research Work Unit description submitted by the Station is concurred in by the Deputy Chief for Research.

4051.6 - Study Plan. The basis for attack upon a problem is the study aimed at the problem or a specific segment of it. Responsibility for preparing study plans normally is assumed by the scientist who will perform the research. He may receive the assistance of the Research Project Leader or a colleague. The study plan should define the proposed study or experiment; review pertinent literature; state the specific objectives sought; and describe the field, laboratory, and office methods to be used. It may also include an estimate of the cost in manpower and funds and assign responsibility for carrying it out.

The purpose of the plan is threefold. It (1) requires the investigator to plan thoroughly his study or experiment and clarify his mind as to objectives and methods, (2) facilitates technical and administrative review and criticism and makes the plan available to other workers, and (3) makes certain that time and changes in personnel do not obscure original objectives and proposed methodology. It may also serve as a set of instructions for technicians performing the work. A study plan shall be written and shall form a part of the study file. Study plans will be reviewed by the Station biometrician as appropriate. Revision is always possible as experience dictates and as the original design permits.

Following is an outline of a study plan that may prove helpful to the investigator. It need not be followed closely if parts of it do not apply:

1. Problem Reference. Indicate to which problem and what aspect of it this study applies.

2. Literature. Review pertinent literature and applicable current studies. -*

*-3. Objectives. State immediate objectives with specific questions to be answered.

4. Methods. Describe the study or experiment including field, laboratory, and office methods. The design of the experiment with the proposed analysis showing basis of test of hypothesis is particularly descriptive as a summary. Under this head consider whether or not the study permits the formulation of an hypothesis with resulting increase in objectivity of the experiment. Give careful consideration to the selection of variables entering into the experiment including those of time, place, and treatment. Consider the sensitivity of the experiment; for instance, its size, the number of replications, the amount of basic data, the refinement in measurement needed, etc.; describe the data to be taken, how they will be recorded, methods of analysis, etc.

5. Presentation of Expected Results. Discuss methods of presentation of expected results, the tabulations and charts contemplated, etc., where possible. This process will help to clarify the value and usefulness of methods described under the preceding item and help to eliminate worthless detail or overrefinements as well as to ensure completeness.

6. Personnel Assignment, Time of Completion, and Cost.

7. Appendix. List here detailed instructions covering necessary operations, choice of instruments, location of suitable area or materials, details of plot arrangement, etc.

At all times it must be remembered that a study plan is a guide, a useful tool, and not a fixed design to be followed slavishly regardless of developments. Intelligent use of such plans greatly expedites work and saves a great deal of time, effort, and money. The Research Project Leader approves study plans for studies listed in an approved problem analysis, subject to review by the Station biometrician as may be prescribed by the Station Director. New discoveries, changes in personnel, or changes in the nature of the problem due to economic or political developments may make it desirable to conduct studies not listed in an approved problem analysis. Such study plans will be approved by the appropriate Assistant Director. A file of approved plans is maintained both at the Research Work Unit location and at Station headquarters.

4051.7 - Pioneering Research Unit. Pioneering Research Units may be recommended by Station or division directors. As with regular Research Work Units, the Deputy Chief for Research will give initial approval to establish each unit and will obtain concurrence by the Chief of the Forest Service and the Department's Director of Science and Education. -*

*-A charter for a Pioneering Research Unit (exhibit 2 at end of sec.) will be prepared in the appropriate Washington Office Research division director's office, together with a summary of the proposal (exhibit 1).

Usually a charter is drawn first in draft form and reviewed by other interested Department agencies. The text will cover the following items:

1. Key scientists to be assigned, including name, grade, and qualifications of each.

2. Objectives of the Pioneering Research Unit.

3. Nature and location of the research, including specific areas of investigation to be undertaken.

4. Resources required, including facilities and finances.

5. Current availability of needed resources.

6. Recent publications of the key scientists that have special significance to their assignments to the Pioneering Research Unit.

In carrying out the terms of the approved charter, the Washington Office division director involved, assisted by his branch chief, will supervise arrangements for the Pioneering Research Unit at a field location. In addition, the division will prepare for information input only parts 1 and 2 of CRIS form 1 (AD-416 and -417).

All Pioneering Research Units, unless otherwise designated, will be assigned to Stations for housing and research-support services. After a Pioneering Research Unit is approved, the Deputy Chief for Research will determine to whom the Unit will be responsible for administrative and technical direction. The responsibility must be assigned to a division director in the Washington Office. In some instances, however, because of location or subject-matter coverage, the responsibility will be assigned to a Station Assistant Director by arrangement with the Station Director. Division directors may delegate responsibility for a pioneering unit to a branch chief to meet Department CRIS needs. A Research Work Unit project description and other CRIS documents will be prepared (FSM 4051.5, 4052.1).-*

*-Exhibit 1

SUMMARY OF PIONEERING RESEARCH UNIT PROPOSAL

Subject: Discoloration and Decay in Forest Trees.

Location of Project: Durham, New Hampshire.

Scientist: Dr. Alex L. Shigo, Research Plant Pathologist, GS-13.

Organizational Relationships: Unit will be part of the Northeastern Forest Experiment Station, which will provide administrative services and research facilities. The Unit will share research facilities with, but will be independent of, the Station's projects at the Forestry Sciences Laboratory, located at Durham, New Hampshire. Broad program direction, review, and coordination will be provided by the Director, Forest Disease Research, Washington, D.C.

Objective: To gain a better understanding of the nature and principles of discoloration and decay processes in trees.

Budget: To establish this pioneering unit, the Northeastern Forest Experiment Station will provide approximately $30,000 from its F.Y. 1968 allotment to Forest Disease Research Project FS-NE-2302(R). In the future this will be increased by direct allotment from the Washington Office.

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*-Exhibit 2

CHARTER FOR PIONEERING UNIT IN DISCOLORATION AND DECAY OF FOREST TREES

Justification: Studies of wood decay by Robert Hartig about 100 years ago were the starting point of forest pathology as a scientific discipline. Investigations of decay since then have been confined largely to three aspects: (1) the taxonomy of the decay-causing fungi (esp. Hymenomycetes), (2) description and measurement of volume loss due to decay (cull) in standing trees and logs, and (3) the deterioration of wood in use by fungi. Emphasis in all cases has been on the final stages of the disease condition, with little attention and research effort on the earlier stages of the process. Significantly, most studies of discolorations have been conducted apart from those of decay and have been restricted largely to blue stain in conifers incited by Ceratocystis spp. A number of individual studies have been conducted on discolorations in hardwoods, particularly in airplane veneers. With very few exceptions the work to date has been applied or missioned centered and not sufficiently penetrating and comprehensive to disclose the true nature of the discoloration and decay processes.

Recent studies at the Northeastern Station suggest that the discoloration and decay processes exist in a very complex interrelationship and, further, that both conditions involve "communities" of organisms apparently operating in a unique manner and sequence. Although these studies have involved hardwood tree species only, they have led to the general hypothesis that the organisms in the discoloration process effect changes in the wood substrate that allow invasion by Hymenomycetes and other organisms causing decay. Thus it can be postulated that the discoloration process can proceed alone, but that it is a necessary precursor to the initiation of decay. The examination of this tentative postulate requires basic study of the beginning stages of the discoloration process, involving bacteria and non-Hymenomycetes, and of the manner in which the decay process is started. Moreover, knowledge of the particular relationship of these processes and associated organisms in coniferous tree species is also essential.

It follows that the physiological mechanisms concerned in these processes must be elucidated, and all organisms of importance must be identified and characterized as to their relation to discoloration and decay of the wood substrate. -*

Study of these destructive processes in the living tree will contribute substantial basic knowledge on tree physiology and the interrelations of microorganisms in tree growth and maturity. It should help to explain susceptibility of resistance to decay in the living tree and its rate of progress. It should also complement basic research on insects and other agents destructive to trees.

The work of this Unit will be generally coordinated with research projects elsewhere in the Forest Service, including those at the Forest Products Laboratory, and other Federal research agencies, universities, and private institutions in this country and abroad. Unit study, under the general concept and approach outlined, will not duplicate work in the Department of Agriculture, or elsewhere.

1. Key Scientist Assigned to Unit: Alex L. Shigo, Research Plant Pathologist, GS-13.

Shigo was born on May 8, 1930, in Duquesne, Pennsylvania. He was graduated from Waynesburg College, Waynesburg, Pennsylvania, in 1956 with a B.S. degree in Biology. He received his M.S. degree in 1958 and his Ph.D. in Plant Pathology in 1959 at West Virginia University. All of his training was financed through assistantships, scholarships, and fellowships. He was awarded the Mycological Society of America Fellowship in 1957 for his research on organism interactions in the oak-wilt disease. Portions of his doctorate research were financed by the National Science Foundation. The basic principles of parasitism were studied using mycoparasites--fungi parasitic on other fungi. This research showed that microelements were important factors affecting the degree of parasitism.

Shigo joined the U.S. Forest Service in September 1959, as a plant pathologist at the Northeastern Forest Experiment Station's research unit at Laconia, New Hampshire. In November 1965, he moved with the unit to Durham, New Hampshire. He is now Principal Mycologist at the Durham unit.

Practically all of his research effort has been devoted to discoloration and decay in northern hardwoods. Dissections of many mature trees in the field were made in attempts to elucidate the patterns of discoloration and decay in living trees. -*

Up to the present a balanced program has been maintained between field and laboratory and fundamental and applied research. His research results indicate that some of the long-standing concepts on discoloration and decay are not completely correct and he has formulated a working hypothesis for basic study of the discoloration and decay process. This includes developing knowledge of the succession of organisms, including bacteria and non-Hymenomycetes. His findings and concepts have received substantial attention among his peers at universities and in governmental agencies, and his work is recognized internationally.

As a result of his research, Shigo is listed in Who's Who in the East, World Who's Who of Scientists, and American Men of science. He has been a member of the Forest Pathology Committee, American Phytopathological Society, since 1962; and has been the Chairman since 1965. He is a member of a technical committee of the International Union of Forestry Research Organizations and has been an invited speaker at two IUFRO meetings. He has been an invited symposium speaker at programs for the American Phytopathological Society; Gordon Research Conference; Berlin, Germany, "Symposium on Wood and Organisms"; and others. Shigo is an Adjunct Associate Professor in the Botany Department at the University of New Hampshire and a Lecturer in the Botany Department at the University of Maine. He has given invitation lectures at Yale, Dartmouth, New York College of Forestry at Syracuse, North Carolina State, Wisconsin, and University of Massachusetts. He has conducted many training sessions for students, foresters, and wood-industry workers.

Shigo is the author of 44 publications. A list of the more important of these relating directly to the basic understanding of decays and discolorations in wood is given at the end of this charter.

2. Objective:

The objective of this Unit will be to elucidate the nature and principles of the discoloration and decay processes in living trees. -*

3. Nature of Research and Its Location:

This Unit will be located at the Northeastern Forest Experiment Station's Forestry Science Laboratory at Durham, New Hampshire. Faculties will be consulted and facilities at the University of New Hampshire will be utilized as authorized under the existing Memorandum of Understanding on cooperative work with this institution.

This research will explore the sequence of physiological and biochemical mechanisms associated with discoloration and decay processes. These mechanisms will be related to and explained in terms of the mode of action of the specific organisms involved. The research must include detailed study of the vital functions of the host tree, of the microorganisms associated in turn with discoloration and decay, and of the interrelations of these with environmental variables intrinsic and extrinsic to the host tree. The tree tissues must be defined chemically, since they are the substrate supporting the growth of the microorganisms. The microorganisms must be characterized as to their nutritional requirements and enzymatic activities. The effects of abiotic factors on these tree and microorganism properties and functions must be determined. The nature and cause of dynamic changes in this system must be assessed. Finally, the relation of all of these considerations to the discoloration and decay processes must be ultimately elucidated and hypotheses tested through field studies and subsequent experimental manipulation of critical variables under controlled conditions.

4. Cooperation:

Cooperation will be developed and maintained (as warranted) with other Federal research agencies, State forestry and pathology research organizations, universities and other private institutions, and Federal and State pest control agencies. An example is the study already under way in the Department of Bacteriology, University of Connecticut, on the role of bacteria in the discoloration and decay processes.

Closer liaison will be developed and maintained with research personnel of the Forest Products Laboratory and with scientists conducting related investigations in foreign laboratories. -*

The University of New Hampshire will provide library and other research facilities, professional consultation in pathology and other subject-matter fields, and forest areas for study.

5. Selected Publications by Alex L. Shigo:

1959. Fungi isolated from oak-wilt trees and their effects on Ceratocystis fagacearum. Mycologia 50: 757-769.

1960. Parasitism of Gonatobotryum fuscum on species of Ceratocystis. Mycologia 52: 584-598.

1960. Mycoparasitism of Gonatobotryum fuscum and Piptocephalis xenophila. Trans. New York Acad. Sci. 22(5): 365-372.

1961. Senior Author. Effects of concentration of host nutrients on parasitism of Piptocephalis xenophila and P. virginiana. Phytopathology 51: 616-620.

1963. Fungi associated with the discolorations around rot columns caused by Fomes igniarius. Plant Disease Rptr. 47: 820-823.

1964. Organism interactions in the beech bark disease. Phytopathology 54: 263-269.

1964. Factors affecting pigmentation by two wood-inhabiting fungi. Phytopathology (Abst.) 54: 907-908.

1965. The pattern of decay and discoloration in northern hardwoods. Phytopathology 55: 648-652.

1966. Organism interactions in decay and discoloration in beech, birch, and maple. U. S. D. A. Res. Paper NE-43, 23 pp.

1966. Decay and discoloration in northern hardwoods: a consideration of microorganism and external signs. Proceedings, IUFRO, Melbourne, Australia. 15 pp.

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1966. Organism interaction in decay and discoloration in beech, birch, and maple. Material und Organismen, Duncker and Humbolt, Berlin, 309-324.

1966. Successions of organisms in discoloration and decay of wood. Inter. Rev. For. Res. II, Academic Press, 65 pp. In Press.

1967. The early stages of discoloration and decay in living hardwoods in Northeastern United States: A consideration of wound-initiated discoloration and heartwood. Proceedings, IUFRO, Munich, Germany. 17 pp.

RECOMMENDED: /s/ M. B. Dickerman
GEORGE M. JEMISON, Deputy Chief for Research, Forest Service By

DATE: October 10, 1967

APPROVED: /s/ Edward P. Cliff
EDWARD P. CLIFF, Chief, Forest Service

DATE: November 13, 1967

APPROVED: /s/ George I. Mehren
DR. GEORGE I. MEHREN, Director of Science and Education, U. S. Department of Agriculture

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*-4051.8 - Inter-Station Research Coordination. The boundaries of Regional Experiment Stations are set to provide working territories for program formulation, administration, coordination of research, and facility planning and management. For many practical reasons these territories are largely prescribed by Station boundaries.

It is becoming more and more common for Research Work Units to embrace problems that extend across more than one Station's area. In some cases the research results have direct application nationally or internationally.

Each Station has the responsibility for informing other Stations when its plans include work which will occur within the geographic territory of another Station. These Stations are encouraged to work out the details of inter-Station collaboration directly with each other. Stations should keep Washington Office branch chiefs and division directors fully informed by copies of correspondence and telephone memorandums documenting inter-Station collaboration. When major budgetary, program, or personnel transfer arrangements are under consideration, the office of the Deputy Chief for Research should be consulted during the planning stage.

4051.9 - Current Program Financing. The task of formulating the current program at the national level is a continuing one, resulting in the annual budget and appropriations for forestry research. In initiating the annual budget request, the Deputy Chief for Research reviews the Department's major program goals and targets. He draws on advice and material from many sources, including the Research Program and Development Staff of the Department; the National Forestry Research Advisory Committee; Washington Office inspection reports on Stations and Regions; communications from Stations and Regions outlining special problems and research needs; conferences with Department of the Interior agencies; and meetings with State agencies, universities, wood-using industries, and others. The annual budget request recommended by the Deputy Chief for Research represents a program reflecting research that will meet Department goals and problem needs. This undergoes review and revision by the Chief's staff, Office of the Secretary, and Bureau of the Budget, being appraised from a cost-benefit point of view at each level. The resulting budget request of the President of the United States, which is submitted to the Congress, is what is feasible within the prevailing Federal financial situation. Appropriation Committees of both Houses of the Congress review the President's budget, and further changes are made before the Congress appropriates funds. The final step in annual program formulation at the national level is the allotment of appropriated funds to the Stations. -*

*-These allotments, reflecting the desires of the Congress for specific program adjustments, are made by functions and by Research Work Units in a way best calculated to meet current research needs.

4052 - RESEARCH PROGRAM REPORTING

4052.1 - Research Work Unit Annual Reports. An annual Forest Service progress report for each approved Research Work Unit covering plans and accomplishments for assigned problems is due in the office of the Deputy Chief for Research not later than March 1, covering the previous calendar year (exhibit 1 at end of sec.).

The annual report for the Research Work Unit provides important information not only to the Research Division directors in the Washington Office, but also to the Station Directors for research program coordination and direction. The Washington Office divisions depend heavily on the annual Research Work Unit reports for information to be used in the preparation of the multiple use report and the Chief's annual report. Also, they provide information needed to support the annual research budget request to the Congress and form the basis for division reporting to the National Forestry Research Advisory Committee on progress and proposed new research.

Finally, the annual reports are an important source of facts for the Department's current research information system (CRIS). To meet this need for CRIS, the Research Project Leader will complete Research Work Unit/Project Description: Progress Report (CRIS form 1-part 4 (AD-421) and submit with his annual Research Work Unit report. Current CRIS instructions will be issued separately.

Five copies of each report, one copy of all published technical papers (including Station papers), are required by the Washington Office. Each Station will provide all other Stations at least one copy of each annual Research Work Unit report. -*

*-Exhibit 1

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

Annual Report for Northeastern Forest Experiment Station
Research Work Unit FS-NE-1501 for Year Ending
December 31, 1966

1. Research Work Unit Location: Burlington, Vermont.

2. Research Work Unit Title: Sugar Maple Sap Production.

3. Mission: To develop more efficient methods of producing sugar maple sap.

4. Summary of Research Work Unit Studies for Each Selected Problem:

Study-Status Table for Research Work Unit

Problem number	January 1, 1966		Changes during year				December 31, 1966	
	Active	Inactive	Begun	Reactivated	Completed	Terminated 1/	Active	Inactive
1	10	0	4	0	0	5	9	0
2	6	0	0	0	0	0	6	0
3	10	0	2	0	0	2	10	0
Total	26		6			7	25	

1/ Studies that have been stopped before completion with no intention of reactivation.

5. Accomplishments for Each Selected Problem:

Problem No. 1--Sap Production Technique.

a. Published:

Blum, B. M. and Koelling, M. R. 1966. Are you tapping deep enough? National Maple Syrup Digest 6: 2. -*

Total taphole depth (including bark) in industry averages less than 3 inches with low sap yields resulting. Increasing depth to a standard $3\frac{1}{4}$ inches into the wood increased sap yields 10 percent. Assuming this treatment applicable to 75 percent of sugar maple sap production, annual benefits would amount to $585,000.

b. Unpublished:

Knowledge of the relationship between xylem tissue age and sap volume and sugar percentage is essential to basic studies of the sap flow process and to general recommendations on tapping depths and sugar bush management. Research indicates that both relationships are curvilinear. Equations derived are: $Y = 6296X - 129.21X^2 + .7056X^3$ where Y = sap yield in milliliters, X = mean tissue age, and multiple correlation coefficient was .93. $Y = 4.324 + 0.78827 \log_{10}\frac{(1)}{X}$ where Y = mean seasonal sap sugar percentage, X = mean xylem tissue age, and the multiple correlation coefficient was .43.

Problem No. 2--Production of Superior Genotypes.

a. Published: None.

b. Unpublished:

The 236 tentative sweet-tree selections, discovered by 70 trained cooperators in 6 states, who tested 21,000 individual trees, were screened by research personnel by specially developed criteria. Only 26 trees met these standards, and 28 trees of slightly lesser qualities were put in a reserve status. These selections will form the basic breeding stock for the production of superior genotypes of sugar maple.

Problem No. 3--Sugar Maple Establishment.

a. Published:

Carl, C.M. and Yawney, H.W. 1966. Four stratification media equally effective in conditioning sugar maple seed for germination. Tree Planters' Notes 77: 24-28. -*

No reliable standard germination technique existed for sugar maple seed. Four stratification media were found to be equally effective using special germination paper in plastic boxes. Also, as a byproduct result of this study, significant tree differences in germination capacity were found to exist. This information will be useful in increasing the efficiency of research effort, and be of future value to commercial producers of sugar maple stock.

MacCollom, G. B. and Yawney, H. W. 1966. Destruction of sugar maple seed by the anthomyiid Hylemya florilega. Jour. Econ. Ent. 60(1): 296-297.

Up to 70 percent of spring sown sugar maple seed failed to emerge in some cases. The cause was found to be the larvae of an anthomyiid. This knowledge will assist in the search for control measures, and result in more efficient nursery operations.

b. Unpublished:

The apparatus developed during the study of apparent photosynthesis and respiration as related to moisture and nutrition requirements of sugar maple is unique, and applicable to most studies of growth in plants. Savings in development costs by only 3 new research units a year, would result in an annual benefit of $30,000.

6. Research Work Unit's Plans for Next Year for All Selected Problems:

Problem No. 1--Sap Production Techniques.

a. New Studies:

Tubing installations. (Determine sap yield differences in vented and unvented systems using groundlines.)

Source of sap. (Compare sap yields from the upper and lower portions of a divided tap hole.)

b. Manuscripts:

Plastic tubing for maple sap collection--comparison of suspended vented and unvented installations (Study No. 45--Station Paper).

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Some observations on off-season tapping of sugar maple (Study No. 47--Station Paper).

Sap sweetness determinations in small sugar maple trees (Study No. 50--Station Note).

Problem No. 2--Production of Superior Genotypes.

a. Studies:

Pollen storage (Determine environmental factors affecting viability).

Breeding sugar maple (Develop techniques for breeding trees of high sugar content).

b. Manuscripts:

An electromechanical extractor for sugar maple pollen (Study No. --None. Station Note).

Problem No. 3--Sugar Maple Establishment.

a. Studies:

Protection from deer browsing. (Determine the effectiveness of several mechanical devices on preventing deer from browsing planted stock.)

Rooting sugar maple cuttings. (Determine the effects of date of collection and stage of development on rooting as related to carbohydrate and nitrogen reserves.)

Survival of rooted cuttings. (Determine effects of several rooting techniques and overwintering treatments on survival.)

b. Manuscripts:

Effect of date of collection on rooting ability of sugar maple cuttings (Study No. 17--Tree Planters' Notes).

Fall sowing of sugar maple seed is superior to spring sowing (Study No. 39--Tree Planters' Notes). -*

*-4052.2 - Study Reports

4052.21 - Establishment Reports. For studies in which long-term plot installations or continuity of observation are required, an establishment report shall be prepared when the plots have been put in. The establishment report will document the date of study establishment; location; details of treatments applied if different from those in the study plan; cost of establishment; and significant observations that may facilitate later interpretation and analysis. In some cases the establishment report may be combined with the first-year progress report.

The establishment report normally should be prepared by the scientist conducting the study. A copy will be filed in the Research Work Unit office and at the Station.

4052.22 - Progress Reports. Periodic progress reports other than the annual Research Work Unit report are essential only for long-term studies. These reports serve to keep the study up to date, provide for review and criticism of results, and supply information for publication. Each progress report shall contain a brief review of study history; any data, techniques, or observations not already recorded in study plans, establishment reports, and previous progress reports; a discussion of the results to date; and recommendations for future action. Progress reports for long-term studies may be the basis for publication of results. The progress report normally should be prepared by the scientist assigned to the study. A copy will be filed in the Research Work Unit office and in the Station Assistant Director's office.

4052.23 - Final Report. When a study is terminated, for any reason, a final report will be prepared to recapitulate the entire study. In most cases the final report will constitute the basis for deciding the possibility for publication. A copy will be filed in the Research Work Unit office and at the Station.

4052.3 - Pioneering Research Unit Annual Report. An annual report for each pioneering research unit will be prepared by the unit leader. No set format is required, but the report should contain a general section on published results, and one copy of each publication should be sent to the appropriate division director along with the report.

A CRIS report on part 4 (AD-421) of CRIS form 1 will be submitted with the annual report. -*

*-4053 - RESEARCH PROGRAM REVIEW. The research program is under more or less continuous review in connection with formulation of budget requests in the Washington Office of the Forest Service and appearances before appropriation and other congressional committees. Nevertheless, special provision has been made for periodic systematic review through Washington Office inspections of Station programs, occasional review of the total program by the National Forestry Research Advisory Committee, and review by Station Assistant Directors of Research Work Units under their supervision through functional supervisory visits.

4053.1 - Annual Review by National Forestry Research Advisory Committee. The National Forestry Research Advisory Committee, appointed by the Secretary of Agriculture, meets at least every 2 years and may review problems, research progress, and make recommendations concerning the forestry research program to the Secretary of Agriculture. The Department's Director of Science and Education prescribes uniform procedures to guide all Department advisory committees.

4053.2 - Periodic Inspections by Washington Office Research. Two types of inspections of Station programs are made by Washington Office Research. A general research inspection (GRI) of each Station is conducted by the Deputy Chief for Research (or the Associate Deputy) at intervals of 5 years (FSM 1441.2). In addition, a general functional inspection (GFI) of each Station is made by each Washington Office division director in company with his branch chiefs at intervals of 5 years (FSM 1441.3). These inspections are carefully scheduled to spread them as evenly as possible over time. For example, two GRI's are scheduled per year for 3 years out of a 5-year cycle and 3 for the remaining 2 years, in order to make a general inspection of each of the current 10 major field units once each 5-year period. Similar scheduling is done for GFI's.

4053.21 - General Research Inspection (GRI). The inspector examines the adequacy of the total Station program, including research support services and all external activities. Although functional review is undertaken in a GRI, the depth required is only that to ensure general agreement with assigned Research Work Unit mission and is not involved with functional technical adequacy. Interfunctional review by the general research inspectors ensures program balance among functional areas as determined in long-range programs. The inspectors are conspicuously alert to new and emerging problems for long-range programing. They will identify needed changes in the allocation of Research Work Units to the Station. -*

*-4053.22 - General Functional Inspection (GFI). The GFI is concerned with the technical programs of a single research function. It examines the adequacy of the Station's organization and effectively implements a functional program. It reviews the scope and adequacy of all technical activities, adequacy of coordination within and between Stations, and external functional cooperation. It provides a check on the effectiveness of the assigned program at all levels of single function within the Station.

The GFI will be sufficiently intensive to provide the basis for recommending revision, termination, and establishment of Research Work Units, or other action required to update all the Research Work Units in the functional area of responsibility. Recommended action on reviewed Research Work Units will be in a separate section of the GFI report under the heading "Review of Research Work Units." Recommendations should be brief, but in sufficient detail to explain the need for the action proposed. Action by the Station on recommendations usually will be within a year after receipt of the approved report.

The action required from the Research Work Unit review may involve discontinuance of some units, continuance of units with no changes, or continuance of units with minor or major changes.

4053.3 - Functional Supervision by Research. Functional supervision visits are made by Assistant Directors for Station Research Work Units and Washington Office branch chiefs for Units under the Washington Office. Supervision visits will be made as frequently as deemed necessary, but at least every other year. Written reports are required.

A functional supervision report need not be lengthy, but it shall record as a minimum the understanding reached between the Assistant Director and the Research Project Leader about the following:

1. Problem Assignment. Changes or modifications needed, if any.

2. Research Progress. Progress on assigned problems should be briefly summarized. The functional supervision report should record deficiencies, if any, in study plans and other research procedures. It should also record agreement on corrective actions contemplated.

3. Research Work Unit Staffing, Training, Safety, Supporting Services and Research Facilities. Deficiencies should be described; remedies and/or recommendations agreed upon should be noted. -*

*-4. Dissemination of Research Results. Plans and progress in publications should be discussed and agreements reached on tentative publications and target dates. Also, such other means of dissemination as field days, workshops for foresters, consultations, and short courses on research results should be emphasized.

A copy of each Research Work Unit functional supervision report shall be kept in a separate folder in the project office. Another copy will be routed to the Station Director for his review and concurrence in actions taken.

Functional supervision visits from the Washington Office are made between GFI's when changes in program or personnel at the Station, or coordination of programs at two or more Stations, requires technical support or advice from a Washington Office branch chief. These functional supervision visits are rather infrequent and usually result from a request by a Station Director. Brief reports go to the Station Director and the appropriate Washington Office division director.

4053.4 - Review and Revision of Research Work Unit Descriptions. A Research Work Unit description is subject to revision whenever a significant change in mission, problems, or approaches is necessary. This could happen at any time during the life of a Research Work Unit. Basic reasons include significant changes in problem composition, financing, personnel, or accomplishment. This will require periodic evaluation of the adequacy and up-to-dateness of all active Research Work Unit descriptions by the responsible Stations. Revised Research Work Unit descriptions will be prepared by the assistant director. To meet Department requirements, research work which is essentially of a continuing type or which is expected to require more than 5 years for completion must be reappraised at least every 5 years and redescribed accordingly. Normally this will occur shortly after the GFI. In all cases a revised Research Work Unit description must be submitted using the same procedures described for new descriptions. Each revised description is subject to the same review and approval as a totally new Research Work Unit proposal. In addition, parts 1 and 2 (AD-416, -417) of CRIS form 1 must also be prepared for the Research Referral Office (RRO) assistant director. A revised Research Work Unit description carries the same Research Work Unit number as the one it replaces and the abbreviation "Rev." Example: FS-NE-1501-Rev.

4053.41 - Discontinuance of Research Work Units. Research Work Units may be discontinued for good reason at any time. Uncompleted but discontinued Research Work Units may be reactivated at any time within the initially approved life by providing notification to the Department's Research Referral Office. The RRO should be notified-*

*-within 30 days of any Research Work Unit that is discontinued or terminated. Notification can be accomplished by submitting part 1 (AD-416) of CRIS form 1. Separate instructions for CRIS notification of discontinuance will be provided.

4053.42 - Duration of Research Work Units. Research Work Units are approved for terms ranging from 1 to 5 years in duration. Continuing research will be covered by the submission of a revised Research Work Unit description every 5 years. If circumstances justify, the initial term may be extended at the discretion of the Deputy Chief for Research. The main reason for an extension is allowing time to actually complete the work.

1. Limitations on Extensions

a. Generally only one extension of not more than 1 year is allowed.

b. The RRO should be notified by the appropriate division director, within 30 days, of all extensions by submission of two copies of part 1 (AD-416) of CRIS form 1 signed by the Deputy Chief for Research.

On all new and revised Research Work Unit descriptions the start and termination dates should be left blank in copies of part 1 (AD-416) of CRIS form 1 submitted to the RRO. The starting date will be inserted by the RRO.

2. Starting Date Determination

a. On in-house Research Work Units, it will be the date of the concurrence signature.

b. On contract Research Work Units, it will be the date of executing the agreement unless otherwise specified.

c. On grant Research Work Units, it will be the date of grant acceptance unless otherwise specified.

3. Termination Date Calculation. The termination date, calculated from estimated duration and start date, will be entered by the RRO.

4054 - RESEARCH SUPPORT FROM OTHER AGENCIES. Some of the research done directly by Forest Service scientists is supported in part by non-Federal agencies and individuals through funds deposited in trust, and some is supported by other Federal agencies through a transfer of Federal funds. -*

*-4054.1 - Support by Non-Federal Agencies. The McSweeney-McNary Act is the principal authority for Forest Service acceptance of funds, and other contributions for forestry research. Such funds are deposited in a trust fund and used for the purpose outlined in an agreement between the Forest Service and the contributor.

In addition to legislative authority, there are a number of Department and Forest Service regulations governing the policy and arrangements for research supported by trust funds. Some of the main policy points are:

1. Research for which contributions may be accepted shall be within the boundaries of approved Forest Service Research Work Units.

2. Contributions to the Forest Service research program may be accepted if there is mutuality and substantive interest in the research to be undertaken, and only if the public interest will be definitely served.

3. The research to be done shall not be completely supported by contributions; some Forest Service regular funds must also be used.

4. Results of the research shall be subject to public disclosure; patentable ideas, products, processes, and equipment developed in the course of the research shall be reserved to the public; endorsement by the Forest Service of any proprietary products or process is prohibited.

For a more complete presentation of policy and procedures regarding research of this type see FSM 4040.

4054.2 - Support by Other Federal Agencies. Research and other services for another Federal agency are authorized by the Economy Act (47 Stat. 417, as amended; 30 U.S.C. 686b; FSM 1020; FSM 6531.15b, item 2). A Station Director may accept work for another Federal agency.

Written approval of the Department's Director of Budget and Finance is required for performing a new type of service not performed previously by the Forest Service for another Federal agency; and his approval in any event is required if the work will cost $200,000 or more.-*

*-In general, the Federal agency for which the research work is being done will specify the degree of security control required; the kind and frequency of reports on results; and the availability of information to the public. In addition, a study plan for the proposed work will be approved by both agencies. No agreement shall be made requiring Forest Service use of appropriated funds for conducting such research, except when provision is made for reimbursing the Forest Service for its expenditures at periodic intervals.

Research and other services performed by the Forest Service for another Federal agency may be exempted from the Research Work Unit procedure by the Deputy Chief for Research.

4055 - RESEARCH SUPPORT FOR OTHER AGENCIES. The Forest Service supports the research of others through transferred funds to other Federal agencies and through contracts and grants to non-Federal agencies.

Indirect research of the Forest Service is done principally through contracts and grants to non-Federal agencies and individuals. Occasionally, some of it is done through transferred funds to another Federal agency. Arrangements for the latter are made in the Washington Office in accordance with Department policy and regulations. In this section, the interest centers on contract and grant research, a feature of growing importance in the Forest Service research program. Some grant research is done through foreign universities and research institutions.

Contract or grant research is authorized under the Whitten Act; Public Law 84-473; Public Law 85-934 (Limited to basic research grants); Public Law 89-106; the Bankhead-Jones Act, as amended; and Public Law 83-480 (Applicable to foreign institutions). Under these acts, regular appropriated funds to the Department and Forest Service for research may be used to support work where it can be performed more effectively, more rapidly, or at less cost than if performed directly by the Forest Service. Much of the support goes to scientists at universities. An important secondary benefit to the Forest Service research program of providing grants for research to universities in the United States is the training of young scientists involved in the research.

4055.1 - Whitten Act Grants. The Whitten Act legislation is listed in FSM 1021. This legislation was proposed by the Forest Service in 1952 in partial response to a request by the House Subcommittee on Agricultural Appropriations to consider ways to stimulate non-Federal cooperation and contributions to the Forest Service research programs. The bill was introduced as an amendment to the-*

*-Granger-Thye Act. Upon passage, it became Public Law 473, 84th Congress. This act also appears in the United States Code under the McSweeney-McNary Act.

Grants under authority of the Whitten Act began gradually in what is frequently referred to in the Forest Service as the cooperative-aid program. Since the instrument commonly used in arranging for such grants is a cooperative agreement, normally entailing some contributions from the cooperator, the reader is referred for details to FSM 4040.

The essential features of use of the Whitten Act grant authority that need emphasis here are:

1. Stations are encouraged to use some of their allocated funds for cooperative aid.

2. Cooperative studies developed by a Station with Whitten Act grants are limited to research areas falling within the boundaries of approved Research Work Units of the Station.

3. Stations normally should limit these grants to colleges and universities within their Station territory. The Forest Products Laboratory should restrict its direct dealing for such grants to institutions in the United States approved by the Deputy Chief for Research where cooperative work is likely to be most productive (FSM 4040.32).

4. Important benefits of Whitten Act grants to university and other cooperators are that they (1) stimulate non-Federal forestry research efforts, (2) provide a medium through which coordination of Forest Service and non-Federal research is helped, (3) further the objectives of the authorized Station Research Work Units in an effective manner, and (4) aid Forest Service research training and recruiting efforts.

4055.2 - Public Law 85-934 Research Grants. Public Law 85-934, September 6, 1958 (42 U.S.C. 1891), authorized the United States Department of Agriculture, where deemed to be in furtherance of its objectives, to make grants for basic research to nonprofit institutions of higher education and to nonprofit organizations whose primary purpose is the conduct of scientific research.

This law was in large part a product of the vision of American scientists interested in advancing the frontiers of scientific knowledge. The approach to the administration of grants for basic forestry research rests on the belief that institutions, organizations, -*

*-and scientists alike wish to share, with the Forest Service, responsibility for the administrative, financial, and scientific integrity of the Forest Service grant program. The purpose of the information contained herein is to encourage an informed cooperation based on this principle.

4055.21 - Forestry Research Grants Handbook (FSH). Details of making and administering research grants under Public Laws 85-934 and 89-106 are contained in this handbook.

4055.3 - Public Law 89-106 Research Grants. Section 2 of Public Law 89-106, August 4, 1965, 89th Congress, authorized the Secretary of Agriculture to make grants, not to exceed 5 years' duration, to State agricultural experiment stations, colleges, universities, and other research institutions and organizations, and to Federal and private organizations and individuals for research to further the programs of the Department. Under this authority, grants are not restricted to basic research or to nonprofit organizations as are the Public Law 85-934 basic research grants.

These research grants are handled directly from the Washington Office. For the most part they will be made to colleges and universities throughout the United States where research on forestry problems can be undertaken with advantage to the Forest Service research program. A separate Research Work Unit description is required for each grant. CRIS documents will be submitted according to separate instructions provided.

4055.4 - Public Law 480 Grants to Foreign Universities. The research under this program of grants is limited to soft-currency countries where there is agreement to use for research purposes a portion of local currency payments for United States surplus agricultural products. The research under these grants is supervised by Washington Office Research. Grants are made only for basic research of benefit to the United States and related to the Forest Service research programs. CRIS documents will be prepared for each Public Law 480 grant according to separate instructions provided.

4055.41 - Handbook on Foreign Research (FSH). The authority, policy, responsibilities, and procedures for research to be done in a foreign country under provisions of the Agricultural Trade Development Assistance Act of 1954, are contained in this handbook.

4056 - RESEARCH STRUCTURES. Modern laboratory and other facilities are basic needs of an in-house research program. For a more detailed and complete discussion of research facilities, see FSM 4060. -*

*-The projected research program (in an unpublished file supplement) includes a list of the permanent locations where major laboratories and related auxiliary buildings and improvements are to be constructed. No permanent structures of this kind should be built at locations other than those designated. Construction or improvement of offices, laboratories, greenhouses, or other structures that cost more than $50,000 shall have approval in advance by the Deputy Chief for Research.

4057 - OPERATING TITLES FOR SCIENTISTS. This section outlines the operating titles that may be used by scientists in the Forest Service research organization.

An operating title may be used to give recognition to the area of specialization and the stature of an individual within the organization, or to identify the level or relationship of the position in the organizational structure. Examples: Silviculturist, principal plant pathologist, chief economist, Research Project Leader, Assistant Director, Director.

Attention should be given to the difference between operating titles and classification titles. A classification title is the official title authorized for a position classified according to the provisions of the Classification Act of 1949, as amended, and the standards and regulations prescribed by the Civil Service Commission. Classification titles shall be used in connection with the preparation of personnel, budget, and fiscal forms. However, operating titles that are authorized herein may be used by research scientists in correspondence, contacts with the public, publications, etc., where administratively it is considered desirable.

4057.1 - Research Staff Titles. Research staff titles are correlated with civil service grades. Illustrations of operating titles that may be used, follow:

Civil Service title	Staff title
Assistant, GS-5 and GS-7	Assistant Silviculturist
Associate, GS-9 and GS-11	Associate Plant Physiologist
(No adjective), GS-12	Entomologist
Principal, GS-13 and GS-14	Principal Chemist
Chief, GS-15 and above	Chief Economist-*

*-These titles may be construed as evidence of stature achieved through accomplishment and indicative of the complexity of research assignment. A research scientist may insert the word "research" before his specialty if deemed desirable. Example: Research Entomologist. In positions above GS-15, the title "Chief Scientist" may be conferred, with the concurrence of the Deputy Chief for Research, upon individuals of extraordinary ability and accomplishment.

4057.2 - Research Organizational Titles. The research organizational titles are correlated with the level or relationship of the position in the organizational structure.

4057.21 - Research Work Unit. The Research Work Unit is an important element of organization in Forest Service research. Accordingly, it is appropriate for supervisory purposes for scientists in charge of such projects to use the operating title "Research Project Leader"; or, if deemed administratively desirable, the operating title "In Charge" may be used in connection with the operating title to further identify responsibility. Examples: John Doe, Research Project Leader; Richard Roe, In Charge of Forest Survey.

A Research Project Leader is primarily a research doer in the Forest Service research organization. His position may be likened to that of captain or leader of a team. He will use his leader operating title only when appropriate. In correspondence with other scientists, publications and the like, he will use an operating title as described in FSM 4057.1.

4057.22 - Pioneering Research Unit. The scientist in charge of a pioneering research unit, or of a field of basic research within the unit, will use an operating title as described in FSM 4057.1.

4057.23 - Laboratory. The term "laboratory" is sometimes used in its classical sense to identify an organizational entity, as the Forest Products Laboratory at Madison, Wisconsin. The operating title of the head of this Laboratory is "Director." On the other hand, the term quite commonly is being used with respect to Stations to identify a research building or a complex of research facilities, often with a grouping of research activities which are like Research Work Units.

These laboratories, which may be several and at various locations within a Station's territory, are under the administration and program management of the Station Director's Office. Nevertheless, there are limited but important functions to be performed by a resident head of such a laboratory; therefore, a suitable operating-*

*-title for the individual selected is administratively desirable. To meet this requirement, a Research Project Leader at a laboratory site may be designated by the Station Director to represent him on those occasions when needed and authorized to use the operating title of "Chief of Laboratory."

The operating title "Chief of Laboratory" has the same meaning as "Director's Representative," which has occasionally been used in the past. Choice of titles shall be the option of the Director.

4057.24 - Research Management. The research management titles being used are "Director," "Assistant Director," "Branch Chief" (Washington Office), "Division Chief" (Forest Products Laboratory), etc. Use of these operating titles will be continued.

4057.3 - Fields of Specialization for Use in Operating Titles. The following specializations, or disciplines, suggested for use in operating titles of Forest Service Research scientists are listed by Research Divisions. Individuals having specialized training and experience in these areas are either now in the research organization or are expected to be in the future as the Forest Service's projected research program develops. It is administratively desirable, for the sake of reasonable uniformity, that operating titles be selected from the following list:-*

*-Operating Titles

Field of specialization	Research Divisions				
	TMR	WRRR	FPR	FPER	FEMR
Aerodynamicist			X		
Agronomist		X			
Analyst, Fire Systems			X		
Analyst, Market					X
Analyst, Operations Research			X	X	
Analyst, Resource					X
Analyst, Systems				X	
Architect					X
Architect, Landscape		X			
Bacteriologist				X	
Bacteriologist, Soil		X			
Biochemist	X	X	X	X	
Biologist, Fisheries		X			
Biologist, Wildlife		X			
Biometrician	X	X	X		X
Biophysicist	X				
Botanist	X	X			
Chemist	X	X	X	X	
Chemist, Physical			X		
Chemist, Soil		X			
Climatologist			X		
Cytologist	X-*				

*-Operating Titles--Continued

Field of specialization	Research Divisions				
	TMR	WRRR	FPR	FPER	FEMR
Dendrologist	X				
Ecologist			X		
Ecologist, Insect			X		
Ecologist, Plant	X	X			
Economist		X		X	X
Electron Microscopist			X		
Engineer			X	X	X
Engineer, Aeronautical Research			X		
Engineer, Agricultural		X			
Engineer, Chemical				X	
Engineer, Civil		X		X	
Engineer, Electronics			X		
Engineer, Equipment			X		
Engineer, Fire Systems			X		
Engineer, Hydraulic		X			
Engineer, Industrial				X	X
Engineer, Mechanical			X	X	
Engineer, Mining		X			
Engineer, Systems				X	
Entomologist			X	X-*	

*-Operating Titles--Continued

Field of specialization	Research Divisions				
	TMR	WRRR	FPR	FPER	FEMR
Geneticist, Plant	X	X	X		
Geneticist, Insect			X		
Geographer		X			
Geologist		X			
Hydrologist		X			
Mathematician			X	X	
Mensurationist	X				X
Meteorologist	X	X	X	X	
Microbiologist		X	X		
Mycologist			X		
Nematologist			X		
Pathologist, Insect			X		
Pathologist, Plant			X	X	
Photogrammetist					X
Physicist		X	X	X	
Physicist, Atmospheric			X		
Physicist, Soil		X	X		
Physiologist, Insect			X		
Physiologist, Plant	X	X	X	X	
Psychologist, Social		X-*			

*-Operating Titles--Continued

Field of specialization	Research Divisions				
	TMR	WRRR	FPR	FPER	FEMR
Scientist, Air Pollution			X		
Scientist, Fire Behavior			X		
Scientist, Fire Control			X		
Scientist, Forest Fuels			X		
Scientist, Range		X			
Scientist, Social		X	X		
Scientist, Soil	X	X	X		
Scientist, Wood				X	
Silviculturist	X	X			X
Sociologist		X	X		
Statistician				X	
Taxonomist, Plant		X		X	
Thermodynamicist			X		
Toxicologist, Insect			X		
Virologist			X		
Wood Technologist				X	X-*

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